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October 19, 2005

HAND-DELIVERY

Nancy C. Wrona
Director, Air Quality Division
ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
1110 West Washington Street
Phoenix, AZ 85007

Re: ***Phelps Dodge Morenci, Inc.'s Comments on Strawman List for Hazardous Air Pollutant (HAP) Source Categories***

Dear Ms. Wrona:

On behalf of Phelps Dodge Morenci, Inc. (Phelps Dodge Morenci), Applied Environmental Consultants, Inc. (AEC) prepared the attached report entitled, "Evaluation of Hazardous Air Pollutant Emissions from the Phelps Dodge Morenci, Inc. Facility and Screen Modeling Conducted for the Arizona HAPRACT Rule" (Report). The Report responds to documents issued by the Arizona Department of Environmental Quality (ADEQ) that show SIC 1021 (Copper Ores) on the strawman list of State HAPs Minor Source Categories, based on ADEQ's review of the Phelps Dodge Morenci facility.

Phelps Dodge Morenci requests that ADEQ reconsider its initial proposal for the copper mining source category. Based on the Report, Phelps Dodge Morenci requests that SIC 1021 be removed from the list of State HAPs Minor Source Categories.

If ADEQ has any questions, please contact me (602-530-8222) or Ken Evans (602-366-8514).

Sincerely,

GALLAGHER & KENNEDY, P.A.

By:
J. Stanton Curry

JSC/sgc

cc: S. Burr
K. Evans
B. Musser

1306220/25103-0200

EVALUATION OF HAZARDOUS AIR POLLUTANT EMISSIONS FROM THE PHELPS DODGE MORENCI, INC. FACILITY AND REVISION TO SCREEN MODELING CONDUCTED FOR THE ARIZONA HAPRACT RULE

October 18, 2005

Prepared for:

Phelps Dodge Morenci, Inc.
4521 U.S. Highway 191
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Prepared by:

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1. INTRODUCTION

As directed by Arizona Revised Statutes §49-426.05 and §49-426.06 enacted in 1992, the Arizona Department of Environmental Quality (ADEQ) is in the rulemaking process for the State Hazardous Air Pollutants (HAPs) Program. These statutes require the installation of Hazardous Air Pollutant Reasonably Available Control Technology (HAPRACT) for new sources or modification of existing sources in specified categories that emit more than 1 tpy of a single HAP or 2.5 tpy of a combination of HAPs.

ADEQ and its contractor, Weston Solutions, Inc., have identified facilities reporting at least 1 tpy of any single HAP, or at least 2.5 tpy of all HAPs by considering previously submitted HAP inventories. Facilities potentially subject to HAPRACT were selected from this list based on modeling which followed the general procedures outlined below:

- Within each 4-digit SIC code, individual emission points were chosen from the available emissions data sources, and paired with the total annual emissions from the HAP database for the facility where the emission point is located.
- Ambient air concentrations were then modeled with a screening air dispersion model.
- If predicted concentrations for any HAP emitted by facilities within the SIC code were greater than 120 percent of the associated short-term (acute) or long-term (chronic) ambient air concentrations (AAC), then that 4-digit SIC code was classified as potentially subject to HAPRACT.
- If predicted concentrations for any HAP emitted by facilities within the SIC code were less than 80 percent of the associated short or long-term AAC, then that 4-digit SIC code was not classified as potentially subject to HAPRACT.
- If predicted concentrations for any HAP emitted by facilities within the SIC code was greater than 80 percent but less than 120 percent of the associated short or long-term AAC, then that 4-digit SIC code was classified as potentially subject to HAPRACT and the AAC was re-evaluated.

As part of this process, the Phelps Dodge Morenci, Inc. (PDMI) copper mining facility in Morenci, Arizona was identified as having emissions of at least 1 tpy of any single HAP, or at least 2.5 tpy of all HAPs. Consequently, initial modeling of these emissions was conducted by ADEQ. The modeling results indicated that the annual ambient impacts due to benzene, manganese compounds and polycyclic organic matter (POM) emissions exceeded the applicable annual AACs.

This document evaluates the benzene, manganese compounds and POM emission rates that were used in the modeling analysis described above and provides revised emission estimates for these pollutants. Additionally, this document presents and compares with applicable AACs, predicted impacts based on the corrected emission rates for each of these pollutants.

2. BASIS OF ADEQ EMISSION RATES AND MODELING RESULTS

2.1 Emission Rates

The benzene, manganese compounds and POM emission rates for the PDMI Facility used in ADEQ's initial screen modeling for the HAPRACT rulemaking was obtained from the 2002 Toxic Release Inventory (TRI) for the State of Arizona. The 2002 TRI reported values for benzene, manganese and POM are as follows:

- Benzene: total of 2,003 lbs/year comprising the following:
  - 2,000 lbs/year fugitive emissions, rounded up from submitted value of 1,972.08 lbs/year
  - 3 lbs/year stack emissions, rounded up from submitted value of 2.71 lbs/year
- Manganese: total of 370 lbs/year comprising the following:
  - all fugitive emissions, rounded up from submitted value of 368.89 lbs/year
- POM: total of 23 lbs/year (value of 22.7 lbs/year used in modeling) comprising the following:
  - 12 lbs/year fugitive emissions, rounded up from submitted value of 11.73 lbs/year
  - 11 lbs/year stack emissions, rounded up from submitted value of 10.96 lbs/year

These 2002 TRI annual totals, reduced to hourly emissions rates by dividing by 8,760 hours/year, were used in the screen modeling.

2.2 Modeling Results

The screen modeling was conducted using EPA's SCREEN3 air dispersion model. The details of ADEQ's modeling methodology are presented in the document: *Procedure for Air Quality Dispersion Modeling for the Arizona HAPRACT Rule*, Weston Solutions Inc., July 2005 (available at ADEQ website at http://www.azdeq.gov/function/laws/draft.html#haps). The modeling for the PDMI Facility assumed all emissions of each pollutant as being emitted from a single stack. Worst-case stack parameters with respect to dispersion characteristics were also assumed and the distance to the first receptor was set at 25 meters. A unit emission rate of 1 g/s was modeled to determine the 1-hour generic impact in $\mu g/m^3$. This value was then multiplied by the actual emission rate of each pollutant to determine the maximum predicted 1-hour impact. Following EPA guidance, the maximum predicted annual impact was set equal to the maximum predicted 1-hour impact multiplied by 0.08.

The complete results of ADEQ's screen modeling for the PDMI Facility are presented in Appendix A and are summarized in Table 2.1. The results indicate that the annual impacts for benzene, manganese and POM exceed the applicable annual AAC.

Table 2.1 Summary of ADEQ Modeling of Benzene, Manganese and POM Emissions From the PDMI Facility

Pollutant	Maximum Predicted 1-Hour Concentration ($\mu g/m^3$)	1-Hour AAC ($\mu g/m^3$)	Percentage of 1-Hour AAC	Maximum Predicted Annual Concentration ($\mu g/m^3$)	Annual AAC ($\mu g/m^3$)	Percentage of Annual AAC
Benzene	5.70	1,280,000	0.00045	0.456	0.243	188
Manganese	1.05	2,500	0.042	0.0842	0.0521	162
POM	0.0646	5,000	0.00129	0.00516	0.00202	256

3. RE-EVALUATION OF EMISSION RATES

A review of the emission calculations for the 2002 TRI showed that tailpipe emissions from haul trucks were included in the reported annual emissions for benzene and POM. Section 302(z) of the Clean Air Act defines a stationary source as: "The term "stationary source" means generally any source of an air pollutant except those emissions resulting directly from an internal combustion engine for transportation purposes or from a nonroad engine or nonroad vehicle as defined in Section 216". Therefore, tailpipe emissions should not be included in the analysis of the PDMI Facility. Corrections to the estimates for benzene and POM emissions discussed below include deletion of haul truck tailpipe emissions that were included in the 2002 TRI.

3.1 Corrected Benzene Emissions

As stated previously, the emission rate for benzene in the 2002 TRI was 2,003 lbs year, comprising the following:

- 2,000 lbs/year fugitive emissions, rounded up from submitted value of 1,972.08 lbs/year
- 3 lbs/year stack emissions, rounded up from submitted value of 2.71 lbs/year

A review of the spreadsheet developed by PDMI for the 2002 TRI (2002 Spreadsheet Determinations.xls), showed that of the submitted fugitive emissions value of 1,972.08 lbs/year, 1,887.24 lbs/year represent tailpipe emissions from haul trucks. With the removal of tailpipe emissions, and based on actual reported values (i.e., no rounding), the corrected benzene emissions are as follows:

- 1,972.08 lbs/year (total fugitive) – 1,887.24 lbs/year (tailpipe) + 2.71 lbs/year (stack) = 87.55 lbs/year

3.2 Corrected POM Emissions

The emission rate for POM in the 2002 TRI was 23 lbs/year, comprising the following:

- 12 lbs/year fugitive emissions, rounded up from submitted value of 11.73 lbs/year
- 11 lbs/year stack emissions, rounded up from submitted value of 10.96 lbs/year

A review of the spreadsheet developed by PDMI for the 2002 TRI referenced above, showed that of the submitted stack emissions value of 10.96 lbs/year, 10.94 lbs/year represent tailpipe emissions from haul trucks.

Additionally, review of the spreadsheet developed by PDMI for the 2002 TRI showed that of the reported 12 lbs/year of POM fugitive emissions (rounded up from submitted value of 11.73 lbs/year), 11.68 lbs/year were reported as being generated from paint. These 11.68 lbs/year of emissions were identified in the paint calculation worksheets developed by PDMI (2002 Gallon Paint.xls) as petroleum distillates but were inadvertently reported as POM emissions.

POM emissions are not generated from paint. In a detailed study prepared by the EPA titled: *Locating and Estimating Air Emissions From Sources of Polycyclic Organic Matter*, EPA-454/R-98-014, July 1998, 45 sub-categories of sources of POM emissions were identified and emissions from naphthalene production and end-use were also evaluated. Nowhere in this document is there mention of POM emissions from paint. POM is most commonly a product of combustion. Thus, the reported POM emissions of 11.68 lbs/year from paint for the PDMI Facility in the 2002 TRI is clearly an error.

Subtracting the tailpipe and paint emissions from the 2002 TRI reported total, results in the following corrected POM emissions estimate:

- 11.73 lbs/year (total fugitive) – 11.68 lbs/year (paint) + 10.96 lbs/year (stack) - 10.94 lbs/year (tailpipe) = 0.07 lbs/year

3.3 Corrected Manganese Emissions

The 2002 TRI reported total manganese emissions of 370 lbs/year (rounded up from submitted value of 368.89 lbs/year). A review of the previously referenced spreadsheet developed by PDMI for the 2002 TRI showed that of this amount, 368.76 lbs/year represent emissions from welding. This value is further segregated into 329.32 lbs/year due to welding conducted by PDMI and 39.44 lbs/year due to welding conducted by Empire, an independent contractor that services specific equipment at the facility. Welding emissions from both PDMI and Empire conservatively were included in the analysis. The manganese emissions from welding were calculated based on the total pounds of all welding electrodes used, regardless of electrode type, times the worst case manganese emission factor listed in AP-42, Section 12.19, Table 12.19-2 (see Appendix B), which was 23.2 lbs per 1,000 lbs of electrode used for electrode type 14Mn-4Cr.

Many of the types of electrodes used by PDMI have specific manganese emission factors listed in AP-42, Section 12.19, Table 12.19-2. In order to obtain representative emissions data, the manganese emissions due to welding were re-calculated using the specific emission factors for each type of electrode. For those electrode types without a specific emission factor listed in AP-42, Table 12.19-2, the worst case emission factor of 2.2 lbs/1,000 lbs of electrode for electrode type E310 was used. The emission factor for electrode type 14Mn-4Cr was not considered because a review of the types of electrodes used by PDMI (see Welding 2002.xls; data not available for Empire) showed that none of the electrodes were of type 14Mn-4Cr. It is also unlikely that Empire uses this type of electrode as they conduct similar welding operations as PDMI at the facility.

The corrected emission calculations are presented in Table 3.1. The corrected total manganese emissions are 18.52 lbs/year.

PDMI will be amending the 2002, 2003, and 2004 TRI reports to incorporate the refinements described above.

Table 3.1 Corrected 2002 Manganese Emissions Due to Welding at the PDMI Facility

Electrode Type	Total 2002 Usage (lbs)	Emission Factor lbs/1000 lbs of Electrode Used [a]	Manganese Emissions (lbs/year)
Welding Conducted by PDMI			
6010 Type	1,750	0.995	1.74
6011 Type	350	0.998	0.35
7018 Type	5,550	1.03	5.72
7056	132	2.2 [b]	0.29
750 Cronaweld	50	2.2 [b]	0.11
308 Type	175	0.252	0.04
71V Type	2,940	0.662	1.95
7025 Outshield	150	2.2 [b]	0.33
316 Type	1,591	0.59	0.94
680 Type	43	2.2 [b]	0.09
Hard Alloy	100	2.2 [b]	0.22
71M Outershield	50	2.2 [b]	0.11
E71 Outershield	550	2.2 [b]	1.21
TIG	500	2.2 [b]	1.10
Stainless Steel Flux	264	2.2 [b]	0.58
Sub-Total	**14,195**	**Sub-Total**	**14.78**
Welding Conducted by Empire			
All types	1,700	2.2 [b]	**3.74**
TOTAL	**15,895**	**TOTAL**	**18.52**

[a] Emission factors from AP-42, Section 12.19, Table 12.19-2.

[b] Value of 2.2 lbs/1000 lbs for electrode type E310.

4. PREDICTED IMPACTS BASED ON CORRECTED EMISSION RATES

As stated previously, a unit emission rate of 1 g/s was initially modeled to determine the 1-hour generic impact in $\mu g/m^3$ for the PDMI Facility. This value was 198 $\mu g/m^3$ (see Appendix A), which was then multiplied by the actual emission rate of each pollutant to determine the maximum predicted 1-hour impacts. The maximum predicted annual impacts were then calculated as the 1-hour impact multiplied by 0.08, following EPA guidance.

Utilizing the 1-hour generic impact of 198 $\mu g/m^3$ for the facility and the corrected benzene, manganese and POM emission rates, the modeling results are revised as shown in Table 4.1. The results show no exceedances of the applicable AACs.

Table 4.1 Modeling Results Based on Corrected Benzene, Manganese and POM Emission Rates

Pollutant	Corrected Annual Emission Rate (lbs/year)	Corrected [a] Hourly Emission Rate (lbs/hour)	Corrected [b] Hourly Emission Rate (g/s)	1-Hour [c] Generic Modeling Impact ($\mu g/m^3$)	Maximum [d] Predicted 1-Hour Concentration ($\mu g/m^3$)	1-Hour AAC ($\mu g/m^3$)	Percentage of 1-Hour AAC	Maximum [e] Predicted Annual Concentration ($\mu g/m^3$)	Annual AAC ($\mu g/m^3$)	Percentage of Annual AAC
Benzene	87.55	0.00999	0.00126	198	0.2495	1,280,000	0.00002	0.01996	0.2430	8.2
Manganese	18.52	0.00211	0.00027	198	0.0535	2,500	0.00214	0.00428	0.0521	8.2
POM	0.07	0.000008	0.000001	198	0.0002	5,000	0.000004	0.000016	0.00202	0.79

[a] Equals annual rate divided by 8760 hours/year.

[b] Equals hourly rate times 0.126 (factor to convert lbs/hour to g/s).

[c] Based on unit emission rate of 1 g/s and initial modeling assumptions (see Section 2 and Appendix A).

[d] Equals generic modeling impact times hourly emission rate in g/s.

[e] Equals maximum predicted 1-hour impact times 0.08 per EPA guidance.

APPENDIX A

ADEQ MODELING RESULTS

Phelps Dodge - Morenci
Stack Parameters

Stack ID	Description	Height (ft)	Diameter (ft)	Temp. (F)	Exit Vel. (ft/s)	Height (m)	Diameter (m)	Temp. (K)	Exit Vel. (m/s)	F_{stk}
51	Unit #1 Turbine	80.0	5.8	100	650	24.4	1.8	311	198	3.72E+06
52	Unit #2 Boiler	80.0	5.8	100	650	24.4	1.8	311	198	3.72E+06
53	Unit #3 Turbine	80.0	5.8	100	650	24.4	1.8	311	198	3.72E+06
62	Small Ind. Steam Generator #1	33.0	2.0	295	38.2	10.1	0.61	419	11.6	1.43E+04
74	Small Ind. Steam Generator #2	33.0	2.0	295	38.2	10.1	0.61	419	11.6	1.43E+04
75	Small Ind. Steam Generator #3	33.0	2.0	295	38.2	10.1	0.61	419	11.6	1.43E+04

Phelps Dodge - Morenci
Screen Modeling Results[a,b]

Stack ID	Pollutant	Emission Rate[c] (lb/hr)	Emission Rate (g/s)	1-Hour Generic Modeling Results {(µg/m³)/(g/s)}	Maximum Predicted 1-Hour Concentration (µg/m³)	Maximum Predicted Annual Concentration (µg/m³)	Distance to Maximum Concentration (m)	Generic Cavity Results {(µg/m³)/(g/s)}	Maximum Cavity Concentration (µg/m³)
62	Benzene	2.29E-01	2.88E-02	198	5.70E+00	4.56E-01	25	0.00E+00	0.00E+00
	Facility - Benzene Maximum Combined Results				**5.70E+00**	**4.56E-01**	**25**	-	**0.00E+00**
62	Manganese Compounds	4.22E-02	5.32E-03	198	1.05E+00	8.42E-02	25	0.00E+00	0.00E+00
	Facility - Manganese Compounds Maximum Combined Results				**1.05E+00**	**8.42E-02**	**25**	-	**0.00E+00**
62	Mercury Compounds	1.37E-03	1.73E-04	198	3.41E-02	2.73E-03	25	0.00E+00	0.00E+00
	Facility - Mercury Compounds Maximum Combined Results				**3.41E-02**	**2.73E-03**	**25**	-	**0.00E+00**
62	Nickel Compounds	1.60E-03	2.01E-04	198	3.98E-02	3.18E-03	25	0.00E+00	0.00E+00
	Facility - Nickel Maximum Combined Results				**3.98E-02**	**3.18E-03**	**25**	-	**0.00E+00**
62	Polycyclic Organic Matter (POM)	2.59E-03	3.27E-04	198	6.46E-02	5.16E-03	25	0.00E+00	0.00E+00
	Facility - POM Maximum Combined Results				**6.46E-02**	**5.16E-03**	**25**	-	**0.00E+00**
62	Toluene	3.88E-01	4.89E-02	198	9.67E+00	7.74E-01	25	0.00E+00	0.00E+00
	Facility - Toluene Maximum Combined Results				**9.67E+00**	**7.74E-01**	**25**	-	**0.00E+00**
62	Xylene (mixed isomers)	8.11E-01	1.02E-01	198	2.02E+01	1.62E+00	25	0.00E+00	0.00E+00
	Facility - Xylene Maximum Combined Results				**2.02E+01**	**1.62E+00**	**25**	-	**0.00E+00**

[a] Results are with building dimensions (Stack ht./1.5 -0.1 m) x 110 m x 280 m). Building length and width estimated from USGS 7.5 minute quadrangle, Clifton, dated 1989.

[b] No specific source emissions provided by ADEQ, therefore facility-wide emissions modeled from only Stack ID #62 (minimum Fstk).

[c] Based upon TRI reported facility-wide Benzene emissions (2,003 lb/yr)/(8,760 hr/yr), Manganese Compound emissions (370 lb/yr)/(8,760 hr/yr), Mercury Compound emissions (12 lb/yr/8,760 hr/yr), Nickel Compound emissions (14 lb/yr)/(8,760 hr/yr), POM emissions (22.7 lb/yr)/(8,760 hr/yr), Toluene emissions (3,401 lb/yr)/(8,760 hr/yr), and Xylene emissions (7,101 lb/yr)/(8,760 hr/yr).

Phelps Dodge - Morenci AAC Analysis

Pollutant	AAC 1-Hour (µg/m³)	AAC Annual (µg/m³)	Percentage of 1-Hour AAC	Percentage of Annual AAC
Benzene	1.28E+06	2.43E-01	4.46E-06	188
Manganese Compounds	2.50E+03	5.21E-02	0.042	162
Mercury Compounds	1.03E+03	3.13E-01	3.33E-03	0.87
Nickel Compounds	5.00E+03	7.90E-03	7.96E-04	40.3
Polycyclic Organic Matter (POM)	5.00E+03	2.02E-03	1.29E-03	256
Toluene	1.92E+06	4.17E+02	5.03E-04	0.19
Xylene (mixed isomers)	1.74E+06	1.04E+02	1.16E-03	1.6

APPENDIX B

AP-42 SECTION 12.19 EMISSION FACTORS FOR WELDING

Table 12.19-2. HAZARDOUS AIR POLLUTANT (HAP) EMISSION FACTORS FOR WELDING OPERATIONS[a]

Welding Process	Electrode Type (With Last 2 Digits Of SCC)		HAP Emission Factor (10^{-1} g/kg [$10^{-1}/10^3$ lb] Of Electrode Consumed)[b]						EMISSION FACTOR RATING
			Cr	Cr(VI)	Co	Mn	Ni	Pb	
SMAW[c] (SCC 3-09-051)	14Mn-4Cr	(-04)	13.9	ND	ND	232	17.1	ND	C
	E11018	(-08)[h]	ND	ND	ND	13.8	ND	ND	C
	E308	(-12)[j]	3.93	3.59	0.01	2.52	0.43	ND	D
	E310	(-16)[k]	25.3	18.8	ND	22.0	1.96	0.24	C
	E316	(-20)[m]	5.22	3.32	ND	5.44	0.55	ND	D
	E410	(-24)[n]	ND	ND	ND	6.85	0.14	ND	C
	E6010	(-28)	0.03	0.01	ND	9.91	0.04	ND	B
	E6011	(-32)	0.05	ND	0.01	9.98	0.05	ND	C
	E6012	(-36)	ND	ND	ND	ND	ND	ND	ND
	E6013	(-40)	0.04	ND	< 0.01	9.45	0.02	ND	B
	E7018	(-44)	0.06	ND	< 0.01	10.3	0.02	ND	C
	E7024	(-48)	0.01	ND	ND	6.29	ND	ND	C
	E7028	(-52)	0.13	ND	ND	8.4612	ND	1.62	C
	E8018	(-56)[p]	0.17	ND	ND	0.3	0.51	ND	C
	E9016	(-60)	ND	ND	ND	ND	ND	ND	ND
	E9018	(-64)[q]	2.12	ND	ND	7.83	0.13	ND	C
	ECoCr	(-68)	ND	ND	ND	ND	ND	ND	ND
	ENi-Cl	(-72)	ND	ND	ND	0.39	8.90	ND	C
	ENiCrMo	(-76)[r]	4.20	ND	ND	0.43	2.47	ND	C
	ENi-Cu-2	(-80)[s]	ND	ND	ND	2.12	4.23	ND	C
GMAW[d,e] (SCC 3-09-052)	E308	(-12)[t]	5.24	ND	< 0.01	3.46	1.84	ND	C
	E70S	(-54)[u]	0.01	ND	< 0.01	3.18	0.01	ND	A
	ER1260	(-10)	0.04	ND	ND	ND	ND	ND	D
	ER5154	(-26)	0.10	ND	ND	0.34	ND	ND	D
	ER316	(-20)[v]	5.28	0.10	ND	2.45	2.26	ND	D
	ERNiCrMo	(-76)[w]	3.53	ND	ND	0.70	12.5	ND	B
	ERNiCu	(-80)[x]	< 0.01	ND	ND	0.22	4.51	ND	C

Table 12.19-2 (cont.).

Welding Process	Electrode Type (With Last 2 Digits Of SCC)		HAP Emission Factor (10^{-1} g/kg [10^{-1} lb/10^3 lb] Of Electrode Consumed)[b]						EMISSION FACTOR RATING
			Cr	Cr(VI)	Co	Mn	Ni	Pb	
FCAW[f,g] (SCC 3-09-053)	E110	(-06)[y]	0.02	ND	ND	20.2	1.12	ND	D
	E11018	(-08)[z]	9.69	ND	ND	7.04	1.02	ND	C
	E308	(-12)	ND	ND	ND	ND	ND	ND	ND
	E316	(-20)[aa]	9.70	1.40	ND	5.90	0.93	ND	B
	E70T	(-54)[bb]	0.04	ND	ND	8.91	0.05	ND	B
	E71T	(-55)[cc]	0.02	ND	< 0.01	6.62	0.04	ND	B
SAW[h] (SCC 3-09-054)	EM12K	(-10)	ND	ND	ND	ND	ND	ND	ND

a References 7-18. SMAW = shielded metal arc welding; GMAW = gas metal arc welding; FCAW = flux cored arc welding; SAW = submerged arc welding. SCC = Source Classification Code. ND = no data.
b Mass of pollutant emitted per unit mass of electrode consumed. Cr = chromium. Cr(VI) = chromium +6 valence state. Co = cobalt. Mn = manganese. Ni = nickel. Pb = lead. All HAP emissions are in the PM-10 size range (particles ≤ 10 μm in aerodynamic diameter).
c Current = 102 to 225 A; voltage = 21 to 34 V.
d Current = 275 to 460 A; voltage = 19 to 32 V.
e Type of shielding gas employed will influence emission factors.
f Current = 160 to 275 A; voltage = 22 to 34 V.
g Current = 450 to 550 A; voltage = 31 to 32 V.
h Includes E11018-M
j Includes E308-16 and E308L-15
k Includes E310-15
m Includes E316-15, E316-16, and E316L-16
n Includes E410-16
p Includes 8018C3
q Includes 9018B3
r Includes ENiCrMo-3 and ENiCrMo-4
s Includes ENi-Cu-2
t Includes E308LSi
u Includes E70S-3, E70S-5, and E70S-6
v Includes ER316I-Si
w Includes ERNiCrMo-3 and ERNiCrMo-4
x Includes ERNiCu-7
y Includes E110TS-K3
z Includes E11018-M
aa Includes E316LT-3
bb Includes E70T-1, E70T-2, E70T-4, E70T-5, E70T-7, and E70T-G
cc Includes E71T-1 and E71T-11